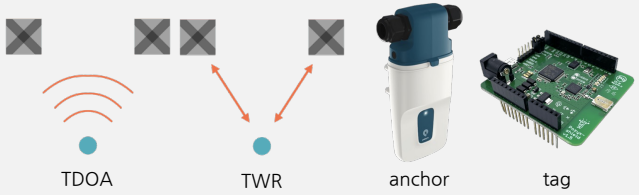
Localization | UWB-based Wireless Positioning System

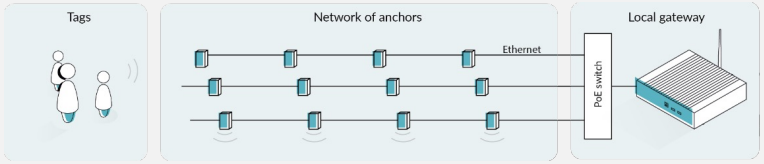
Introduction

- Due to the **weight capacity of the balloon-drone**, making it impossible to use laser-based sensors.
- Ultra-wideband sensor uses **several anchors** to position the **tag position.**

How

1) Sets up **anchor configuration for precise positioning.**
2) Mount **tag** to the robot.
3) TDOA protocol for **swarm positioning** (up to 50 drones)
4) TWR protocol for single drone control.
5) Applied **complementary filter** for IMU calibration, and **LPF** for strong Z axis oscillations.
6) Applied **madgwick AHRS filter** for align global axes.



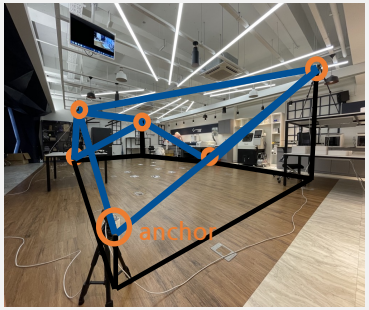


Network of anchors and tags

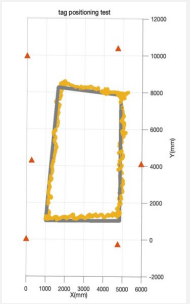
Goal

- Aims for an **precise positioning, which enables swarm control.**
- Robot capable of autonomous navigation to a target location using **real-time positioning** based on UWB (Ultrawide Band)

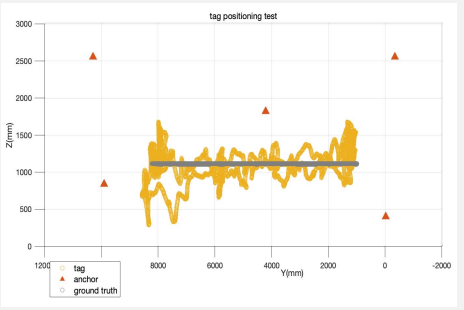
Experiment scenarios



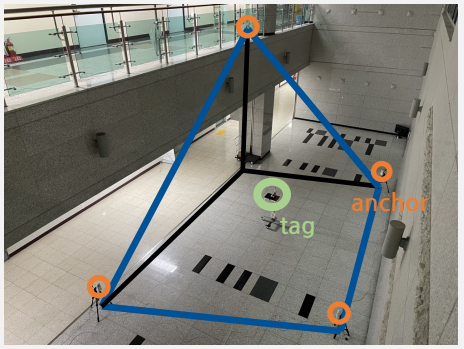
Experimental env. configuration



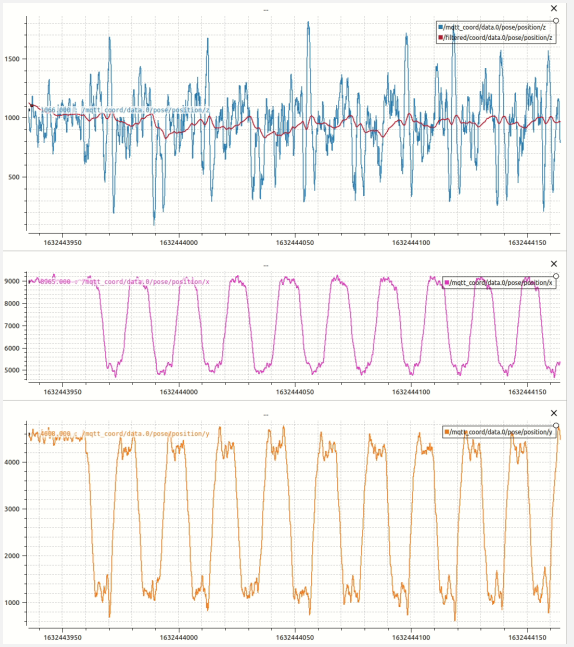
X-Y plane



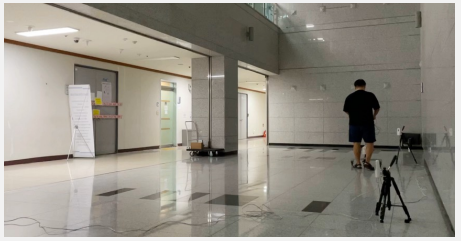
Y-Z Plane output with ground truth



Experimental environment configuration



Filtered output of tag position (z, x, y)



Real-time Positioning Experiments

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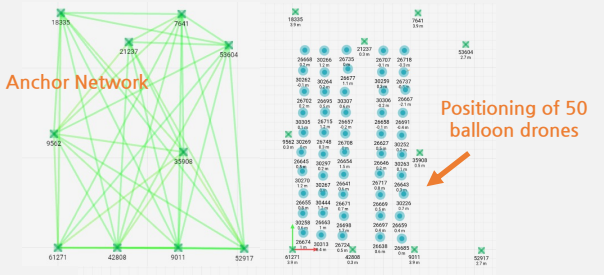
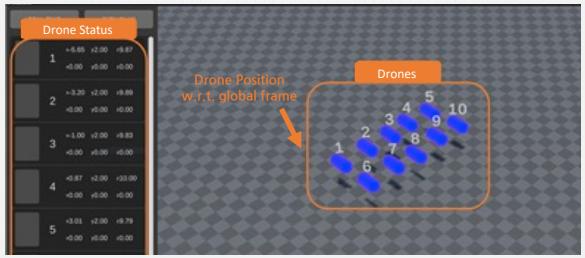
Implementation for Swarm Control

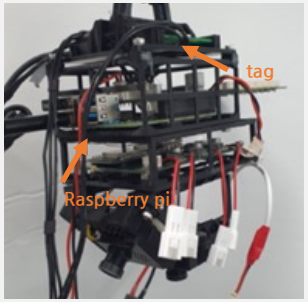




GUI created with Unity for intuitive observation and control

Experimental environment configuration

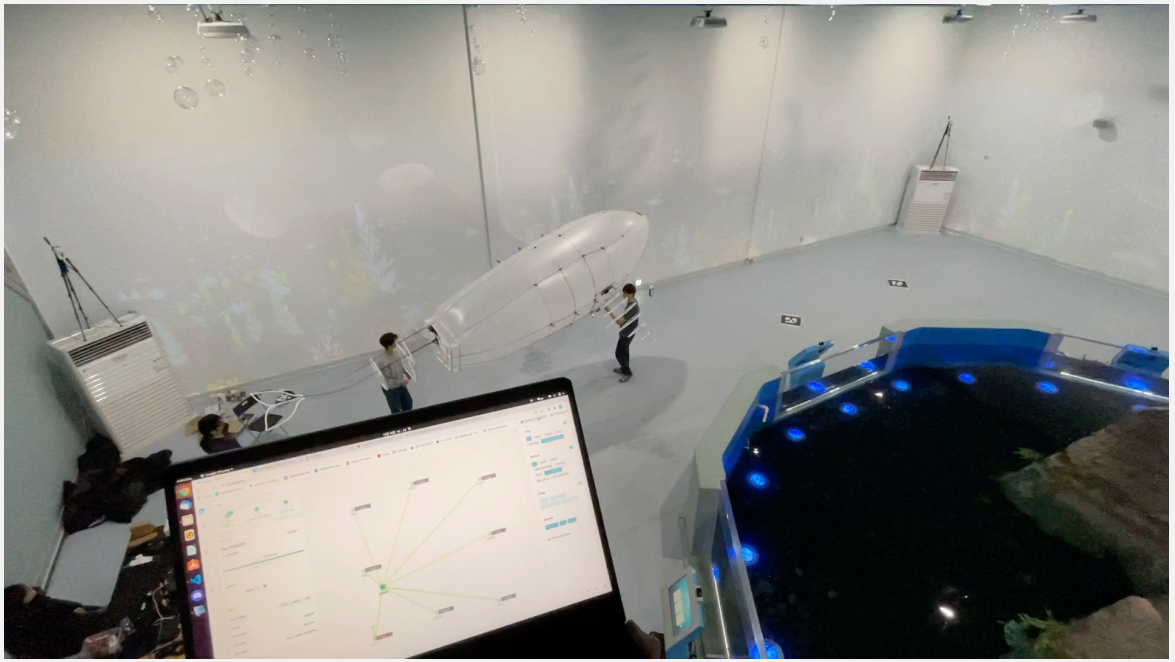
Balloon-type drone Implementation



Tag Installation

Anchor Installation

Experimental environment configuration



Real-time positioning result, communication via MQTT network